were observed which corresponded with the marked changes found in the lumbar cord. The tumor on the right sixth nerve should have caused paralysis of the external rectus muscle of the right eye. The right eye had been tested shortly before death but no such paralysis was observed. On the peripheral side of the gumma this nerve did contain a number of well preserved nerve fibres, and this, too, in spite of the fact that the fibres could not be traced through the tumor. In the first place it is remarkable that the nerve should not have been destroyed, and in the second place that it should transmit despite the fact that the nerve fibre could not be traced through it.

WALDEYER, *Ueber einige neuere Forschungen im Gebiete der Anatomie des Centralnervensystems*, Deutsche med. Wochenschr. 1891 XVII 1213, 1244, 1267, 1287, 1331, 1352.

This review of recent work on the finer anatomy of the nervous system is from the hand of an acknowledged master. It is intended to show how far the improvements in the histological technique have, during the past few years, revolutionized the views on the architecture of the nervous system. The first paper starts with a historical review of the subject up to the year 1880, throwing into a scheme the ideas then current. Next follows a statement of Golgi's principle results. Undisputed is his observation that the nerve process (axis-cylinder process or prolongation) is branched, and that in certain cases it branches so much as to lose its identity within the gray matter about it. Disputed are his interpretation of the two sorts of cells as sensory and motor and his hypothesis that the branches from the nerve-process form a morphologically continuous net work throughout the nervous system and that the protoplasmic processes are purely nutritive in function. The points of difference in the views of the brothers Ramon y Cajal and Golgi are clearly stated. One very important point in the conception of the nerve cell is the value to be attached to the protoplasmic prolongations. There is much to be said in favor of the view that they possess functions not dissimilar in kind from those of the nerve process.

In order to form a picture of the arrangement of the elements in the spinal cord it is to be remembered that we have to deal within the cord with (1) commissure-cells (Commissurenzellen), (2) the column-cells (Strangzellen), (3) the nerve-root cells (Nervenwurzelzellen), (4) the cells of the dorsal cornua with the diffusely branching nerve-process. Outside of the cord lie the cells of the spinal ganglia. In general the relation of these elements appears to be the following: The fibres of the dorsal roots—for the most part taking origin from the ganglia of the dorsal root—enter the cord and there divide into an ascending and a descending ramus. From the rami arise at short intervals the so-called collateral branches which penetrate the gray substance and end in terminal brushes. The relation of these terminations to the cells is a close one but nevertheless not that of continuity. To follow the relations topographically, there are in the dorsal cornua the cells with the diffusely branching nerve process, the function of which is not evident. In the column of Clark, or Stilling's dorsal nucleus—as Waldeyer prefers to call it—the cells appear of the group designated as column-cells. Their nerve process passes to the lateral column and they may or may not divide into an ascending and a descending ramus. If undivided the fibre turns cephalad and, in any case, gives off collaterals along its course. In most parts of the gray matter cells of this class are to be found. The commissure-cells differ from the last only in the fact that the nerves coming from them cross the middle line by way of the ventral commissure before they turn longitudinally.

The root fibre cells form a final group. In most of them the nerve-

process gives off but a small number of branches near its origin and in some animals none at all have yet been discovered. The nerve processes for the most part pass into the ventral nerve roots but in some instances a group of cells mainly in the lateral portion of the ventral cornua send their nerve-processes to the dorsal roots. Thus some fibres in the dorsal roots arise from cells within the cord, a fact for which there has long been good pathological evidence. In the third paper the relations of the nerve elements in the cortex of the cerebellum and cerebrum is discussed. Some account of the relations in the cerebellum has already been given (this JOURNAL, Vol. III, No. 4, Feb. 1891). The account of matter in the cerebrum is taken from Ramon. The large pyramids whose pyramidal prolongation with its protoplasmic branches may extend almost to the sub-pial layer has a nerve-process which may contribute to any of the principal fibre-systems of the hemispheres and the branches of which also form modulated fibres as shown by Flechsig. Above and below the large pyramids lie triangular or small pyramidal cells, the lower layer of which have the peculiarity that their nerve process is directed towards the cortex. In the cortex of the rabbit S. Ramon has found bipolar cells and also triangular ones with several nerve prolongations both of which are entirely new elements in this region. In the fourth article it is principally the comparative anatomy of the nerve elements which is considered, especial weight being laid on the relations existing in the invertebrates. Without sufficient grounds, as it seems to us, Waldeyer concludes in favor of direct anastomoses between cells in both vertebrates and invertebrates. In the crustacea which he examined Retzius considers almost all the ganglion cells as monopolar. The nerve process however has lateral branches, but no nerve fiber takes its origin from these branches. In the crabs the sensory and motor fibres appear to arise in the same manner and we have then both sorts of cells centrally located and in physiological connection by the lateral branches of the nerve-process.

These general views find support in the arrangements within both the olfactory and optic apparatus. Here there is evidence for two sets of fibres originating from separated groups of cells and running in opposite directions. In the case of the olfactory it would appear that some cells of the sensory nasal epithelium are cells of origin for nerve fibres passing from them to the bulb. One question of prime importance in connection with the supporting tissues of the nervous system is whether these are derived from the epiblast alone or from this layer and the mesoblast. This is one of the matters discussed in the fifth paper and although it must be still left open, the evidence appears to be strong that these tissues have a double origin. In the final paper the various points discussed are brought into a general view and illustrated by schemata. Some of the principle conclusions are the following. The axis-cylinder of all nerve fibres is the direct outgrowth of a nerve cell and in no case does it arise out of a net work of fibres. All nerve fibres end free in a terminal-brush and in no case is there formed an anastomosing net-work. The entire nervous system can be considered as built of a series of units. Each unit is the cell and its outgrowths. This unit Waldeyer designates as a neuron. As a rule the order of arrangement is such that physiological connection is established by the terminal brush of one neuron expanding in the neighborhood of the cell-body of the next. The arrangement in the glomeruli of the olfactory bulb suggests that in certain cases the terminal brushes of two nervous-processes may be directly approximated. In considering the value of the nerve cells, Waldeyer discusses the hypothesis of Nansen that the nerve cells are simply nutritive and do not form part of the pathway for the nervous impulses, coming to the conclusion that the evidence for Nansen's view is at present insufficient.

Two very general matters may be mentioned in conclusion. First, up to recently it has been generally held that the method of silver impregnation depended solely on a deposit of metal in lymph-spaces, to this Waldeyer adds a possible staining of certain elements which if it means anything means that the reaction takes place within the substance stained and not around it. Second, Kölliker in discussing this subject has laid great stress on the question how far the fibres brought out represent those which are modulated and how far those which are non-modulated. On this point Waldeyer has nothing to say.

OBERSTEINER, *Anleitung beim Studium der Baues der nervösen Centralorgane im gesunden und kranken Zustand*, 2. Aufl., Leipzig 1892.

The first edition of this admirable work was received with general rejoicings and was, at the time, reviewed in these columns. (AM. JOUR. OF PSYCHOLOGY, Vol. II, No. 2, Feb. 1889.) Since then (1890) it has undergone translation at the hands of Dr. Alex. Hill, of Downing College, Cambridge, England. The translation is good and the English edition differs from the original German in containing certain addenda, (always bracketed in the text), in which, for the most part, the translator presents some morphological views of his own. We do not propose to attempt here more than to point out some features of the second German edition as compared with the first. The fundamental character and arrangement are unchanged; as the author tells us in the preface, the text has been carefully worked over. The result is about one hundred pages more of reading matter and several new cuts.

A first-class book of this kind is in some sense a work of art and as such must have its sketchy portions. At the same time it is sure to be judged by what is best in it which, in this case, is the anatomical matter —in the stricter sense of the term. Where the evidence for views is physiological or developmental, the author's critical sense is less helpful to the reader. We have said that the book has grown and that in parts it is sketchy; it is to be devoutly hoped that it may remain so and stop growing. Even in this second edition there are introduced new things, presumably for the sake of completeness, which weaken its character as a critical essay. It seems the fate of many strong books to thus undergo in later editions a form of fatty degeneration where bulk is gained and tone is lost, and the perspective of the subject is damaged. Turning now to details, several matters call for notice.

The section on methods is fuller and more accurate than before. Take it all in all this chapter forms the best manual on the histological methods for the nervous system that we have. In discussing the method of degeneration it does not appear why Schwalbe's hypothetical nerve fibre with two nutritive centres should be introduced. It represents a purely formal difficulty. The development of the central nervous system is just touched upon and histogensis is hardly mentioned. In the chapter in morphology Fig. 20 is not without fault. The lateral plexus appears to be cut off from the rest of the velum and the stria cornea is represented on one side only.

In considering the fissuration of the hemispheres the author holds closely to Ecker. Eberstaller's contributions to the subject are recognized in the text and we should be glad to see his boundaries for the occipital lobe accepted in the figures. These figures (24-27) can certainly be improved. The central fissure should cut the mantel-edge and the relations of the interparietal sulcus and parieto-occipital fissure in Fig. 24 are quite misleading. The parieto-occipital fissure normally cuts the mantel-edge much in front of the point at which it is indicated. And furthermore the figures do not agree among themselves in representing this relation.